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Movement of the Dogbane Beetle, *Chrysochus auratus* (Coleoptera: Chrysomelidae), in a Patchy Environment

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The dogbane beetle, *Chrysochus auratus* (Fabricius), is an herbivorous beetle widely distributed in the eastern and midwestern United States (Wilcox, 1975). *Chrysochus auratus* feeds almost exclusively on plants of the genus *Apocynum*, particularly *A. cannabinum* L. (Indian hemp) and *A. androsaemifolium* L. (spreading dogbane) (Weiss and West, 1921; Dussourd and Eisner, 1987; Williams, 1988b, 1991). Adults are foliovores, feeding chiefly on *Apocynum* leaves; larvae are fossorial and feed on *Apocynum* roots (Felt, 1901; Weiss and West, 1921).

The population ecology of *C. auratus* has been little studied. cursory observations suggest that adults often occur in small, sporadically distributed populations even when host plants are abundant (Williams, 1988b), similar to the distribution of the red milkweed beetle, *Tetraopes tetraophthalmus* (Forster) (Coleoptera: Cerambycidae) (McCauley et al., 1981; McCauley, 1989), among patches of *Asclepias*. Limited dispersal of adults is a major factor affecting the distribution of *T. tetraophthalmus* among host plant patches (McCauley et al., 1981; McCauley, 1989). As the life histories of *C. auratus* and *T. tetraophthalmus* are strikingly similar (see Lawrence, 1988, for a review of the life history of *T. tetraophthalmus*), might limited dispersal abilities of *C. auratus* adults explain in part the sporadic distribution of this species among patches of *Apocynum*?

In this note, I describe the movement patterns of a small population of *C. auratus* adults within and among patches of *Apocynum* in the Ridge and Valley Province of southwestern Virginia. Specific attention is given to: 1) the frequency of intra- and interpatch movements; and 2) the length of time adults remain in *Apocynum* patches (patch tenure time). Patch tenure time was of interest as extended residency in host plant patches may enable some specialist insect herbivores to more fully exploit unpredictable host plant resources (e.g., Bach,

1982; Williams, 1988a).

This study was conducted from June to August 1989 in a small old field bordering a commercial Christmas tree plantation in Blacksburg, Montgomery County, Virginia. Observations of *C. auratus* adults were centered primarily on three patches of *A. cannabinum* known to be inhabited by beetles in previous years. Patch 1 consisted of 19 stems (\bar{x} height = 80.5±3.8 cm, mean±SE), patch 2 of 12 stems (\bar{x} height = 71.1±3.6 cm) and patch 3 of 44 stems (\bar{x} height = 50.7±3.0 cm). The *Apocynum* patches were in a linear array with patches separated by ca. 20 m. Additionally, three host plant patches located >200 m from the primary *Apocynum* patches were monitored to determine if long-distance exchanges of beetles might occur (two patches were dominated by *A. androsaemifolium* [9 and 15 stems], one patch by *A. cannabinum* [27 stems]). No other *Apocynum* patches occurred in the conifer plantation or old field.

All *Apocynum* stems in the patches were tagged with numbered plastic bird bands (National Tag and Band Co., Newport, Kentucky) during early June. *Apocynum* patches were searched daily between 1300 and 1500 hr for *C. auratus* adults beginning in mid-June and until beetles were no longer found (early August). When discovered, individual beetles were each marked with a unique pattern of enamel paint on elytra (preliminary observations indicated that marking did not affect beetle movement), and placed at the base of stems from which they were captured. Location of marked beetles was recorded for each sampling day, and the daily distance moved by beetles within the primary *Apocynum* patches was determined by measuring the straight-line distance between recaptures (Smith and Grodowitz, 1987). Since beetle sample sizes were small, no attempt was made to determine differences in dispersal between the sexes.

The total number of *C. auratus* adults observed in the

six *Apocynum* patches was low. Seventeen beetles were captured during the study: 15 beetles within the three primary *Apocynum* patches and 2 beetles in two of the three distant patches. Of the 15 *C. auratus* adults marked in the primary patches, 10 (67%) were recaptured more than once. Beetles were observed most frequently in *Apocynum* patch 1 followed by patches 2 and 3 (Fig. 1). The majority of beetles captured in the primary patches were first encountered in *Apocynum* patch 1 (12 beetles).

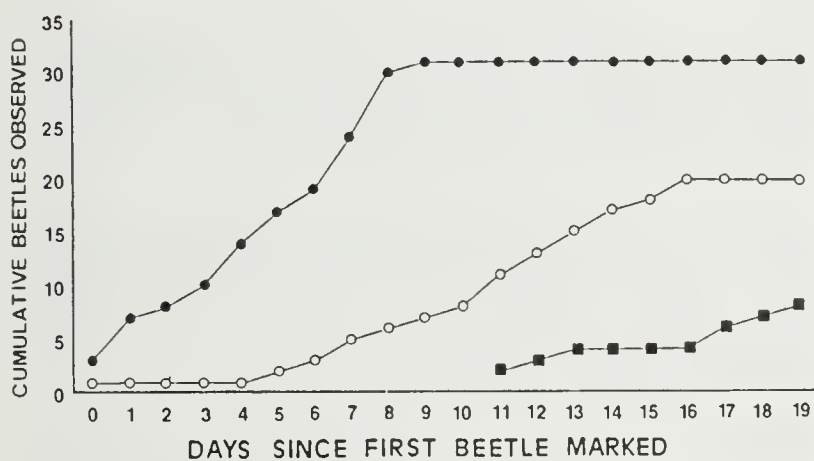


Figure 1. Cumulative observations of *Chrysochus auratus* adults in the three primary *Apocynum* patches, July to August 1989. Closed circles = patch 1, open circles = patch 2, closed blocks = patch 3.

Short-distance movements of 5 m or less were most frequently observed for marked *C. auratus* adults, comprising 82.2% of recorded movements (Fig. 2). Short-distance movements typically consisted of within patch, plant to plant movements. Movements of 12 m or greater (17.8%) were primarily dispersal flights in which beetles either colonized adjacent *Apocynum* patches or left the study area. Interpatch movements, however, were recorded infrequently; only five beetles were recaptured in *Apocynum* patches other than those in which they

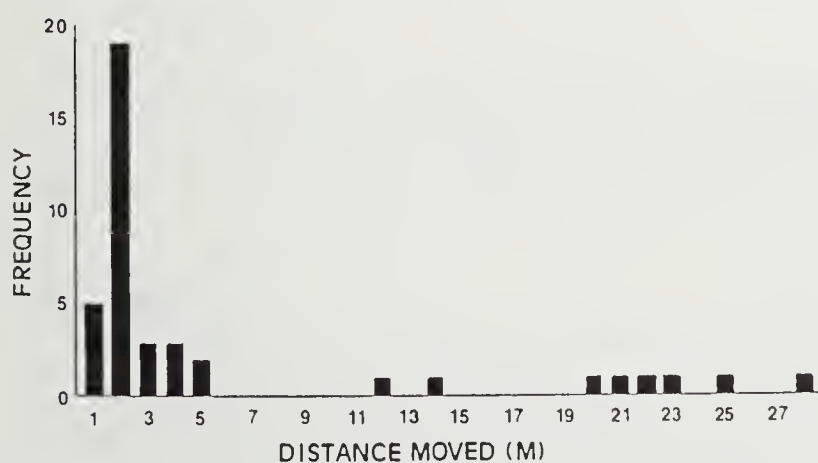


Figure 2. Frequency distribution of movements for recaptured individuals of *Chrysochus auratus* in the three primary *Apocynum* patches, July to August 1989.

were first encountered. No interpatch exchanges occurred between beetles marked in the three primary *Apocynum* patches and those marked in distant patches. Patch tenure time for beetles in the three primary *Apocynum* patches averaged 3.2 ± 0.7 days (range = 1-9).

Population size, patch tenure time, and the distribution of movements that I recorded for *C. auratus* are comparable to observations of *T. tetraophthalmus* reported in several studies (McCauley et al., 1981; Lawrence, 1988; McCauley, 1989). Among small host plant patches, both insects exhibit a preponderance of short-distance, plant to plant movements, relatively low patch tenure times (some specialist herbivorous insects remain in patches for several weeks; see Bach, 1982; Williams, 1988a), and small population sizes. My results, although limited, do not directly demonstrate that *C. auratus* adults are poor dispersers (e.g., it is unknown how far adults moved once they left the study area) or that limited dispersal influences the distribution of the species among *Apocynum* patches. Instead, the low frequency of interpatch movements recorded during this study suggests that *C. auratus* may be a relatively poor colonizer of patchy host plant resources.

Numerous factors may influence the probability that a host plant patch is colonized by herbivorous insects, including the number of host plants in a patch, and the chemical and physical distinctness of the host plant patch from the surrounding vegetational matrix (patch apparency) (Root, 1973). These factors are also primary correlates of herbivore population size (e.g., Cromartie, 1975; Lawrence, 1988). Unfortunately, given the small number of beetles encountered during this study, no association of *Apocynum* patch attributes with either *C. auratus* population size or colonizer success could be made.

Low success in host location may only partially explain the sporadic distribution of *C. auratus* among *Apocynum* patches. The size and persistence of *C. auratus* populations may also depend on the availability of larval food resources. Patches of *Apocynum* with considerable root biomass, such as older well established patches, should support larger populations of *C. auratus* larvae and ultimately produce more adults. Well established *Apocynum* patches could be sources of dispersing beetles that may then colonize adjacent patches (for example, contrast the number of beetles first encountered in *Apocynum* patch 1, an apparent source patch, with the other patches). Thus, availability of larval food resources, in conjunction with the host location abilities of adults, may determine the distribution and abundance of *C. auratus* among *Apocynum* patches.

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